

Balance in Astronauts Performing Jumps, Walking and Quiet Stance Following Spaceflight

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Introduction: Both balance and locomotor ataxia is severe in astronauts returning from spaceflight with serious implications for unassisted landings. As a part of an ongoing effort to demonstrate the functional significance of the postflight ataxia problem our laboratory has evaluated jumping, walking heel-to-toe and quiet stance balance immediately following spaceflight. **Methods:** Six astronauts from 12-16 day flights and three from 6-month flights were asked to perform three self-initiated two-footed jumps from a 30-cm-high platform, walking for 10 steps (three trials) placing the feet heel to toe in tandem, arms folded across the chest and the eyes closed, and lastly, recover from a simulated fall by standing from a prone position on the floor and with eyes open maintain a quiet stance for 3 min with arms relaxed along the side of the body and feet comfortably positioned on a force plate. Crewmembers were tested twice before flight, on landing day (short-duration), and days 1, 6, and 30 following all flight durations.

Results/Conclusions: Many of astronauts tested fell on their first postflight jump but recovered by the third jump showing a rapid learning progression. Changes in take-off strategy were clearly evident in duration of time in the air between the platform and the ground (significant reduction in time to land), and also in increased asymmetry in foot latencies on take-off postflight. During the tandem heel-to-toe walking task there was a significant decrease in percentage of correct steps on landing day (short-duration crew) and on first day following landing (long-duration) with only partial recovery the following day. Astronauts for both short and long duration flight times appeared to be unaware of foot position relative to their bodies or the floor. During quiet stance most of crewmembers tested exhibited increased stochastic activity (larger short-term COP diffusion coefficients postflight in all planes and increases in mean sway speed).